BOEING

MODEL 502-12B
gas turbine-driven COMPRESSOR

D4-1660

BOEING MODEL 502-12B
GAS TURBINE-DRIVEN COMPRESSOR

Date: October 5, 1961

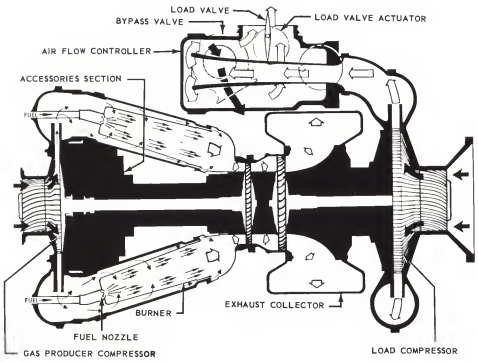
THE BOEING COMPANY
INDUSTRIAL PRODUCTS DIVISION

D4-1660

Model Specification

Boeing Model 502-12B Gas Turbine-Driven Compressor

For Commercial Sale



AIR FLOW DIAGRAM OF ENGINE

LEGEND	
	Inlet Air
	Compressed Air
	Combustion
	Products of Combustion (Exhaust)
	Load Air
	Bypass Air

I. DESCRIPTION

The Boeing Model 502-12B gas turbine-driven compressor is a compact, lightweight source of air for starting jet aircraft engines, or for other industrial applications requiring high volumes of relatively low pressure air. This engine is a further development of the 502 series engines.

The Model 502-12B engine consists of two major sections: a gas-producer section and an output-compressor section. The gas-producer section incorporates a single-stage, single-entry centrifugal compressor coupled to a single-stage axial-flow turbine, two cross-connected combustion chambers of the through flow type, and an accessory drive unit. The output-compressor section incorporates a second axial-flow turbine coupled to a single-entry centrifugal compressor, and an airflow controller. There is no connection between the two sections other than the shroud which confines the flow of gases and the engine frame which mechanically positions the two units relative to each other. The compressed air delivered by the engine follows a path through the output-compressor section completely separate from the air which flows through the gas-producer section, and the turbine of the output sections. An oil cooler of the air-oil type is located at the inlet to the load compressor on most installations.

II. PERFORMANCE

Typical engine performance is expected to be in accordance with Table I. The performance listed is obtained with the oil cooler installed at the load-compressor inlet. The delivered air pressure and temperature listed are those measured at the airflow-controller outlet.

TABLE I

Normal Continuous Rating Ambient Conditions: 60°F, 29.92 Inches Hg					
Gas Producer (rpm)	Exhaust Gas Temp. (°F)	Fuel Flow (Lb/Hr)	Del. Air Flow (Lb/Min)	Del. Air Press. (psia)	Del. Air Temp. (°F)
37,000	1075	255	118	52	420

The gas-producer governor throttle stop will be set before delivery so that at full throttle the delivered air pressure and airflow will be as listed in Table I. This is the only performance warranty expressed or implied and is the basis for engine acceptance limits.

Figures 1 and 2 show the variation of delivered air pressure and temperature with delivered airflow at normal continuous gas-producer speed. Normal continuous performance at inlet air conditions other than 60°F, and 29.92 inches Hg is shown on Figure 3. Part throttle performance at reduced power setting is shown on Figure 4.

III. ENGINE WEIGHT

The dry weight of the engine with standard equipment, as listed in Section IV A, is nominally 440 pounds.

IV. EQUIPMENT AND ACCESSORIES

A. Standard Equipment

The following accessories will be supplied with the engine as standard equipment:

1. Fuel control and gas-producer governor unit
2. Airflow controller with electric shutoff valve
3. Starter-generator
4. Starter relay
5. Centrifugal switch for automatic start sequencing
6. Ignition coil, and igniter plugs with suitable leads (without radio shielding)
7. Ignition relay
8. Oil pump
9. Oil filter
10. Oil-pressure-sending unit
11. Tachometer-generator drive on gas producer
12. Exhaust gas thermocouples
13. Single-outlet exhaust collector with insulation blankets
14. Rubber engine mounts

B. Optional Equipment

The following accessories are available as optional equipment at extra cost:

1. Electrically driven fuel boost pump
2. Fuel filters, primary and secondary
3. Automatic start control box (includes exhaust gas temperature gage and oil pressure gage)
4. Voltage regulator
5. Electrical tachometer-generator and indicator for gas-producer section
6. Oil temperature thermocouple
7. Oil temperature gage
8. Oil cooler, air-to-oil, with mounting adapter and oil lines for installation at load-compressor inlet
9. Inlet silencer and clamp for gas producer
10. Air inlet bell and clamp for gas producer
11. Sump breathers
12. Air by-pass duct
13. Exhaust stack extension (for mounting breather and by-pass duct)

V. ACCESSORY DRIVES

A drive for an electrical tachometer-generator is provided on the gas-producer accessory section. With the exception of speed, this is an AND 20005, type XV-B drive. The ratio of drive to gas-producer-rotor-shaft speed is 0.100:1, and rotation is counterclockwise. Maximum continuous torque is 7 pound-inches rotating or 50 pound-inches static.

VI. FUEL SYSTEM

The Boeing 502-12B gas turbine compressor has been developed to operate on a number of fuels, including diesel oil, kerosene, gasoline, and aircraft turbine jet-engine fuel conforming to MIL-F-5624A, grade JP-4, without changes to the fuel system. Unless otherwise specified, the engine will be adjusted and acceptance tested on kerosene fuel. Special operating precautions are necessary when operating in multi-fuel service, and instructions should be obtained from The Boeing Company.

The gas-producer section of the engine is equipped with a fuel control unit which incorporates an acceleration limiter. Fuel is supplied to the burner nozzles by the engine-driven fuel pump through the governor which regulates fuel flow to maintain a gas-producer speed which corresponds to the governor's throttle arm setting. An electrically operated fuel shutoff valve is included in the fuel system.

Fuel must be supplied to the inlet of the engine-driven fuel pump at a pressure of 5 to 15 psig, with contamination not to exceed that which will pass through a 10-micron filter.

VII. ELECTRICAL SYSTEM

The engine is supplied with a 24-volt direct current, negative ground electrical system. A permanently coupled starter-generator cranks the engine during starting and provides electrical power when driven by the engine. Maximum output of the starter-generator is 30 amps at a nominal 24 volts DC.

The ignition system consists of a capacitance discharge ignition unit and two vaporizing-type spark plugs with suitable leads. The ignition system is connected so that it is automatically energized whenever the starter circuit is energized.

VIII. LUBRICATION SYSTEM

The complete lubrication system, except for the oil cooler and its connecting oil lines, is supplied with the engine. A six-quart oil sump is part of the gas-producer section. A double-element oil pump supplies oil under pressure via a full-flow micronic filter to the bearings and gears, and scavenges the oil from the output-compressor section.

Normal oil consumption is less than one quart in four hours of operation. A bayonet-type gage is included with the engine and is marked to indicate FULL when the sump contains six quarts and the engine is level. An oil drain plug is located at the bottom of the oil sump.

Oil pressure normally will vary from 30 to 50 psi at rated speed to 15 psi at idle. The oil pump pressure relief valve setting can be adjusted externally. An electrical oil pressure sensing unit is installed on the engine to operate in conjunction with the oil pressure gage mounted on the automatic start box.

Heat rejection to the oil at normal rated power is estimated to be not more than 1000 BTU/minute. During normal operation the temperature of the oil entering the engine should never exceed 200°F.

An oil cooler must be provided in the pressure line from the oil sump. Oil supply ports to and from the cooler are provided on the engine. The type and size of oil cooler will depend on the particular installation. Following a study of the proposed installation, The Boeing Company will provide recommendations for the oil cooler system. It should be noted that the air-to-oil cooler mounted in the load-compressor inlet (Section IV B, Item 8) is a satisfactory configuration for most applications.

IX. AIRFLOW CONTROLLER

The airflow controller monitors the flow being delivered by the engine, and discharges air to the atmosphere through a by-pass valve as necessary to prevent load-compressor surge. Included in the airflow controller is an electrically operated load valve which permits the air delivered by the engine to be rapidly shut off or turned on.

X. INSTALLATION

The engine is provided with a four-point mounting system for attachment to supporting structure. The engine mounts shown on Boeing drawing 45-2711 are furnished as standard equipment. The engine has been designed for continuous operation in all positions not exceeding 20 degrees inclination from the horizontal.

The polar moments of inertia of the rotating masses of the engine are approximately as follows:

1. Gas-producer rotor assembly -0.20 lb-in. sec^2
2. Output compressor-turbine rotor assembly-0.32 lb-in. sec^2

Other installation details and dimensions are shown on Boeing drawing 45-2711.

XI. DESIGN CHANGES

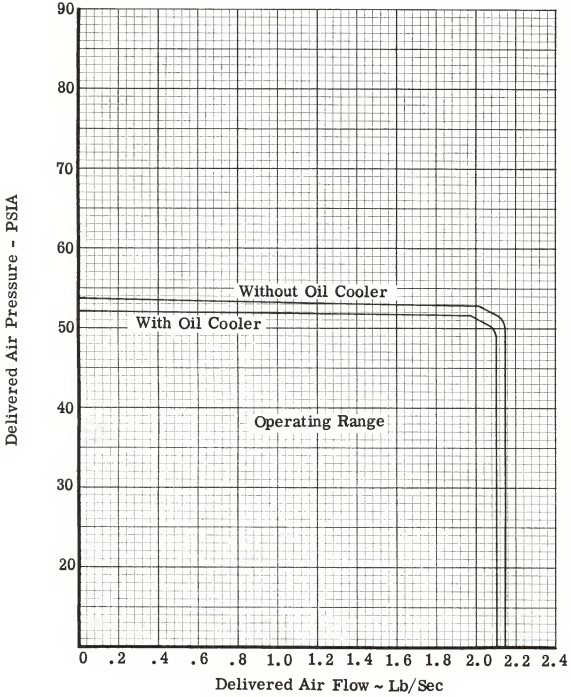
The Boeing Company reserves the right to make design changes. Efforts will be made to coordinate these changes where installation or operation may be affected.

XII. INSPECTION AND TESTS

Testing performed on the units by Boeing will be only that required to ensure proper performance of the unit before delivery. These tests will include engine performance calibration and acceptance tests in accordance with established Boeing Company standards.

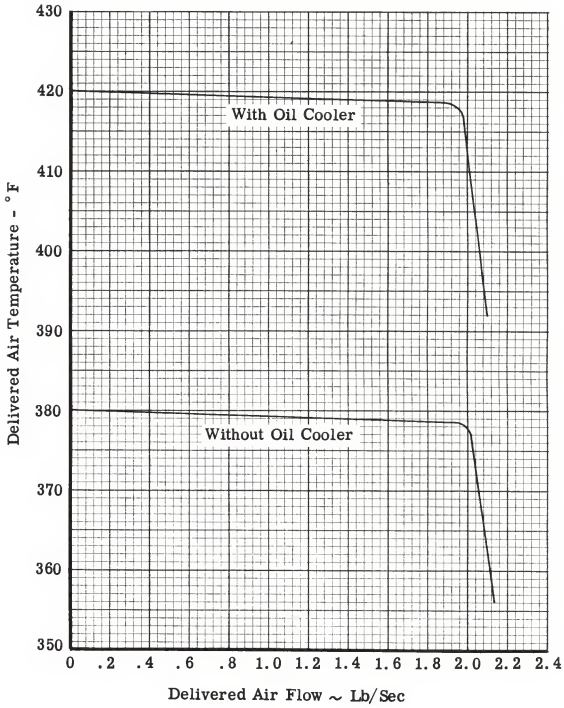
XIII. PACKAGING AND PACKING

Packing for shipment will be performed by Boeing in such a manner as to ensure acceptance by common or other carrier for safe transportation at the lowest rate to the point of delivery unless otherwise mutually agreed.



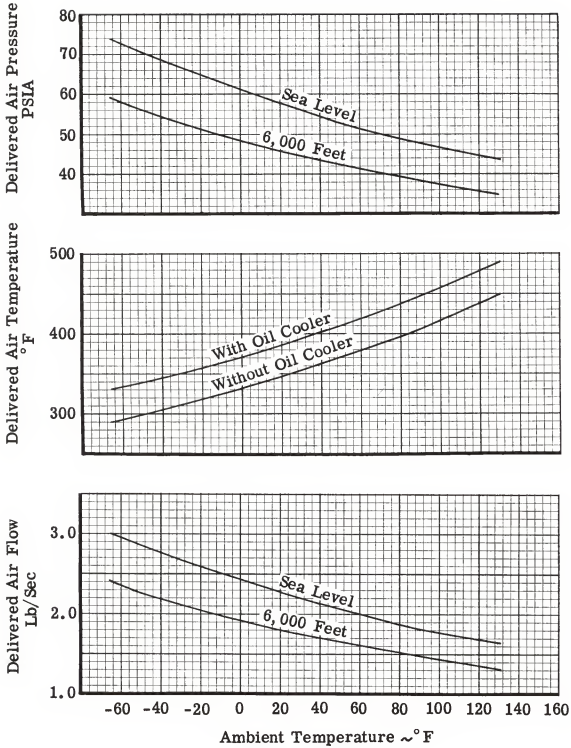
EXPECTED NORMAL CONTINUOUS PERFORMANCE
Delivered Air Pressure vs Delivered Air Flow
Ambient Conditions - 60°F, 29.92 In. Hg

Figure 1



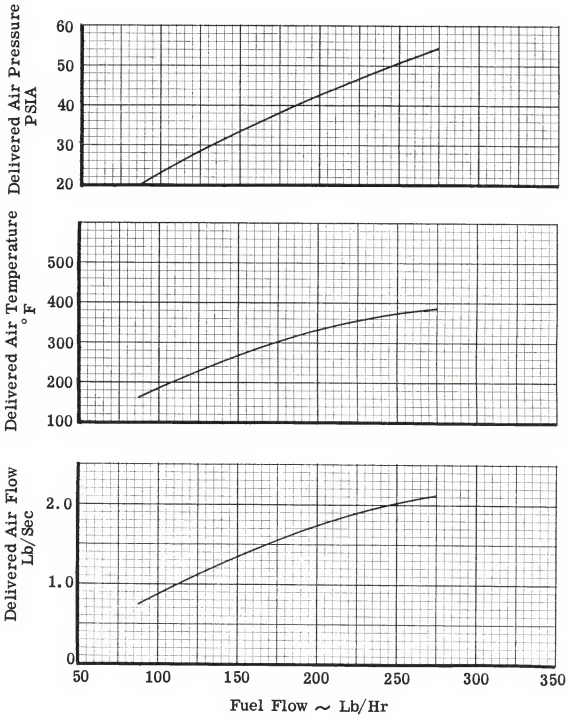
EXPECTED NORMAL CONTINUOUS PERFORMANCE
Delivered Air Temperature vs Delivered Air Flow
Ambient Conditions - 60°F, 29.92 In. Hg

Figure 2



EXPECTED NORMAL CONTINUOUS PERFORMANCE

Figure 3

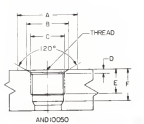


EXPECTED PERFORMANCE
At Reduced Power Settings

Figure 4

THE BOEING COMPANY • INDUSTRIAL PRODUCTS DIVISION

1 CENTRIFUGAL SWITCH
2 FUEL INLET (SEE AND 10050-6)
3 FUEL PUMP DRAIN (1/4 O.D. TUBE)
4 OIL PRESSURE SENDING UNIT
5 OIL OUTLET TO COOLER (SEE AND 10050-8)
6 OIL COOLER RETURN (SEE AND 10050-8)
7 ENGINE MOUNTS-FRONT
8 RECEPTACLE-ELECTRICAL SYSTEM
9 STARTER RELAY
10 ENGINE MOUNTS-REAR
11 DRAIN FITTING (SEE MS33656-4)
12 FUEL PUMP & GOVERNOR
13 PRESSURE FITTING-NOZZLE BOX (1/8 NPT)
14 IGNITION RELAY
15 BY-PASS AIR OUTLET
16 OIL BREATHER-SECOND STAGE
17 FUEL DRAIN-NOZZLE BOX (1/4 O.D. TUBE)
18 LOAD VALVE
19 OIL DRAIN & SCREEN-MAIN SUMP
20 IGNITION UNIT
21 OIL FILTER
22 IGNITION PLUG
23 THERMOCOUPLE-HARNESS
24 EXHAUST COLLECTOR-SINGLE OUTLET
25 STARTER GENERATOR
26 OIL FILLER
27 DRAIN-OIL FILTER
28 OIL DIPSTICK
29 SPEED CONTROL LEVER
30 AIR INLET COMPRESSOR(GAS PRODUCER)
31 AIR INLET-COMPRESSOR (OUTPUT)
32 OIL BREATHER
33 COMPRESSED AIR PRESSURE FITTING (AND 10056-2 FITTING END)
34 COMPRESSED AIR OUTLET
35 FUEL SOLENOID
36 HOUR METER
37 START COUNTER

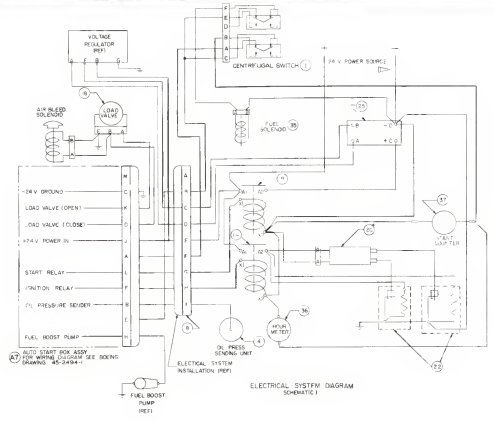


AND 10050

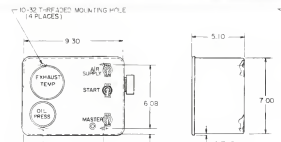
PART	DASH	THREAD	TUBE OD	A	B	C	D	E	F
2	-6	9/16-18 UNF-3B	3/8	.969	.688	.580	.063	.469	.594
6 5	-8	3/4-16 UNF-3B	1/2	1.188	.875	.769	.094	.562	.718

OPTIONAL EQUIPMENT

A1 STACK EXTENSION
A2 BREATHER TUBE
A3 BREATHER DUCT
A4 BY-PASS TUBE
A5 INLET BELL
A6 MARMAN CLAMP
A7 AUTO START BOX

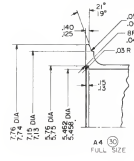


ELECTRICAL SYSTEM DIAGRAM (SCHEMATIC)



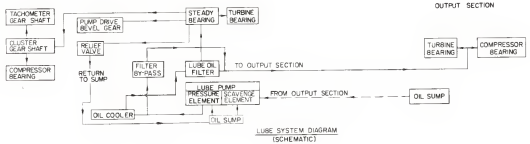
AUTO START BOX ASSY (47) (HALF SIZE)

SEE

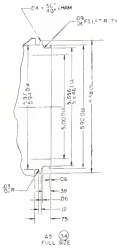


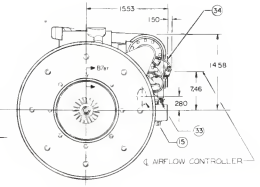
GAS PRODUCER SECTION

OUTPUT SECTION

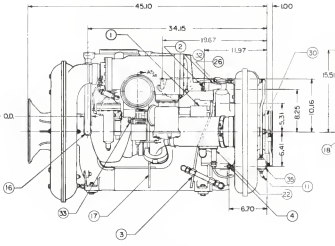


LUBE SYSTEM DIAGRAM (SCHEMATIC)

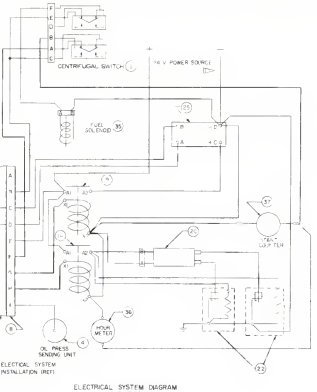




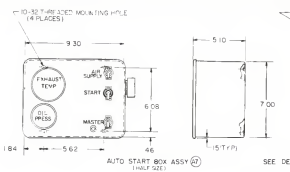
REAR END VIEW

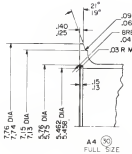


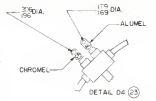
R.H. SIDE VIEW

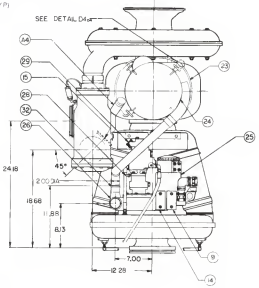


ELECTRICAL SYSTEM DIAGRAM
SCHEMATIC

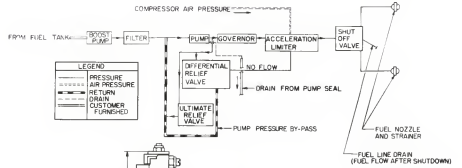


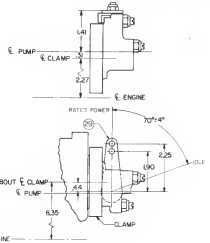


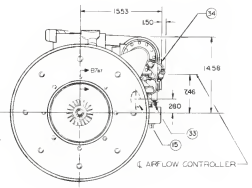


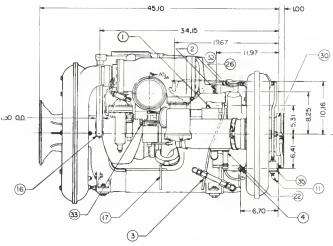


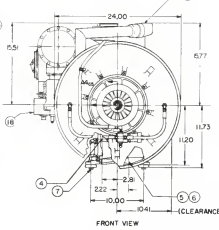
FUEL SYSTEM DIAGRAM

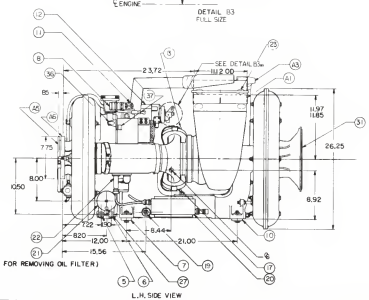












ELECTRICAL WIRING HARNESS & INSULATING BLANKETS NOT SHOWN

▷ MOUNTING BOLT DIA .50

▷ CUSTOMER FURNISHED

SCALE QUARTER SIZE AND NOTED
ALL DIMENSIONS IN INCHES

502-2B EVAPORATIVE COOLING INSTALLATION
MODEL 502-2B

45-2711